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MARX AND THE MACHINE

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With the reference to the phylogeny of machines, which ranges from complex tools to machines driven by motors to automatons, Marx always combines a genealogy of technology shaped by capital and thus clearly sets himself apart from a transhistorical theory of the evolution of technology. Marx writes: “Work is organized and divided differently according to the tools it has at its disposal. The hand mill requires a different division of labor than the steam mill. It is thus a matter of slapping history in the face when one begins with the division of labour in general, in order subsequently to arrive at a special instrument of production, the machines”. (MEW 4: 149) Marx does not seem to attach too much importance to the phylogenetic evolution of machines when he writes, for example, that the machine simply lacks the historical element that he qualifies here as its purely economic determination. (Cf. Bahr 1983: 152) Marx rejects an evolution-theoretical pattern for the description of machines, because he is always concerned with the aspect of maximizing the efficiency and efficient functionalization of machines, as long as the improvements serve the economic calculation of capital.

In his discussion of Proudhon, Marx emphasizes that the machine is not in itself a historical or economic category, and only as part of a socio-economic structure or with its integration into the context of capital does it become an economic concept. Marx is therefore particularly interested in the question of how the machinery is to be analyzed under the aspect of the dominance of the economy of capital. Here, the term machinery is to be preferred to that of the machine because it makes it clearer that technology, which always represents a structure (of technical objects), can be described as the material mode of existence of capital. At the same time, it should be noted that Marx’s use of the term “mechanism”, which he uses to describe machinery, implicitly results in a certain neglect of the concept of production (in the sense of production) in relation to that of reproduction. Even the introduction of the concept of “extended reproduction” does not change this, and so Marx must at the same time adhere to an asymmetrical concept of force, which he associates with the ecstatizing labor force, the output of which shoots beyond its input (non-equivalence) or the use of which by the capitalist drives its value generation beyond its reproduction costs.1 The historical sequence of stages embedded in the economic concept of machinery, according to which the manufactory division of labor has provided the basis for the specialization of the instruments of labor, whereupon the unification of the specialized instruments of labor (and with it a new stage of the division of labor) has enabled the transition to the machine, remains questionable. In the study of Marx’s excerpts on the division of labour, machinery and industry (Marx 1982), it is

noticeable that Marx, with regard to his studies on manufactory, initially still proceeds from a living active "organism", within which the living labor force combines with a series of assembled ahuman technical objects, in order finally to be subordinated in this structure itself, not only with regard to the dissection of the functions of the labor force, but also through the mathematically writable dissection of the social labor body as a whole. (Cf. also MEW 23: 401)

Marx writes with regard to the living total worker in the manufactory: "The division of work according to the manufactory not only simplifies and multiplies the qualitatively differentiated organs of the social total worker, but also creates a mathematically fixed ratio for the quantitative size of these organs, i.e. for the relative size of the working groups in each special function. With the qualitative structure it develops the quantitative rule and proportionality of the social working process". (MEW 23: 366) So there is a mathematically writable, a calculable relationship when many who are gathered in one space do the same thing at the same time. And certain partial operations on the object take place uniformly within the already divided total worker in the manufactory upon instruction. And this type of production also requires specific tools, which are initially created by adaptation to the partial operations of the partial workers, who in turn function as parts of a total worker (division of labor). (Ibid.: 361) Finally, there is a permanent restructuring of the work equipment or tools, which can finally incorporate several partial tasks as machine tools. The development of the machine tool almost inevitably leads to a single element to complex and assembled machine tools that reflect the division of labour of the manufactory in some way; the individual parts are now similar organs within a movement mechanism or a combined tool mechanism. (ibid.: 399ff.)

It is thus the internal division of labor in the manufactory that produces the "machine" as a tool that is initially only composed, and thus it seems only possible to grasp the machine as a socio-economic concept (objectification of a socio-economic practice). However, in many of Marx's statements a positive attitude towards mapping theory still continues, in so far as machine tools first of all depicted simple manual tools and then expanded their potential by carrying out operations much more effectively than a worker used to do them with simple tools. (ibid.: 393) Almost in the same breath, Marx speaks of the machine tool as a mechanism in the sense of a structure of material bodies, and at the same time he extends the term "mechanism" to the axiomatics of machinery in general. Only in this sense did the machine tool become decisive for industrial production, "namely as the transformation of a still partially qualitative concept of machine into an axiomatized, mathematical-logical one". (Bahr 1983: 261) Tools are then under no circumstances to be understood as the extension or reinforcement of the physical organs of the worker, whereby the problem of force still sticking to the anthropological loses its significance compared to the regulated, quantifiable arrangement of the workers in space. In general, one can already say here that for Marx the technical objects coagulate into elements of extended technological systems in which the cooperation and division of labor as well as the partial workers enter alongside the machines themselves. (ibid.: 268)

Any change in the constellation (division and composition) of the total worker as a social worker entails a restructuring of the working instruments and vice versa. What the individual tool and the worker already begin to integrate into a "machine" in the manufactory is first and foremost the internal division of labor between human and non-human actants. The division of labor already tends to form the (tool) machine. Marx writes: "This part of the machinery, the machine tool, is what the industrial revolution of the 18th century was based on". (MEW 23: 393)

It should be noted, however, that production in the manufactory, which took place in Europe from the 16th century onwards, initially had only a model character; it had by no means been generalised into the 18th century as the materialisation of a dominant capitalist mode of production. It is necessary to take into account the craftsmanship of the manufactory, with which the division of labour could not go beyond a certain degree of complexity over long periods. Christine Woesler explains in this context that between the 16th and 18th centuries it was rather the division of labour in the entire body of society that increased and in some areas led to the higher qualification of activities in areas such as weaving and lace-making.2 (Woesler 1978: 317) In the early stage of the manufactory, the relationship of the worker who works on an object with a tool to the craft was still largely intact, insofar as expression of power and dexterity were essential characteristics of his work. On the one hand, intellectual capacities materialized in the tools; on the other hand, the worker's production knowledge from the craft continued to exist for generations. (Incidentally, the transmission mechanism in the manufactory often consisted of women or children who transported the respective partial products). From the 16th to the 18th century, the most common form of manufacture was therefore a heterogeneous manufacture, in which a large number of workers concentrated in one place produced a common end product (printing and cloth production) within the framework of the division of tasks into different sub-areas. In France, the manufactories (silk spinning in Lyon, pottery in Sevres, etc.) were mostly under the control of the absolutist state. (ibid.: 322) And the supply of the army with products – weapons and clothing – played a role not to be underestimated in the socio-economic establishment of the manufactory.

If Marx refers in his analyses of capital to the manufactory, then rather to the manufactory of the 18th century, in which the handicraft character of the work is increasingly suppressed and the cooperative character of the overall work in favour of the emergence and dominance of management functions has been changed. In the manufactory, the clock, or more precisely the time of day, was by no means as important as it would later be in industrial production.3 The clock is not identical with the time of day; it only becomes the time of day when economy, technology, power and nature converge under very specific conditions. The manufactory did not yet materialize one of the essential principles of the capitalist production process, namely the uniform movement of machines. (ibid.: 198) Only as a tendency can concepts such as uniformity, continuity, regularity and order, as decisive characteristics of a divided work organization, be applied to the manufactory.4 (MEW 23: 365) "In der Tendenz" also means that, viewed purely from the technical point of view, there was no compelling necessity of development from the manufactory to mature industrial production in the factory, whereby only with this did the material mode of existence of capital

according to the monetary utilization of capital be achieved. In general, with Ellen Meiksin's Wood, it should be noted that industrialization or the industrial factory was the result, not the cause, of the capital economy, which is characterized by the imperatives of profit maximization, capital accumulation, and the increase in productivity qua competition inscribed in it. (Meiksins Wood 2015: 84) Only in and with industrial production could the constancy of product quality, anticipatory calculation and mathematically exact calculation of output quantities be guaranteed. Woesler points out that the struggle of the capitalists in the cloth industry against factory legislation in 1864 was counterproductive in terms of enforcing the principle of machinization and increasing relative value-added production, because it was precisely these capitalists – who were successful at the time – who wanted to maintain the principle of increasing the absolute added value by extending the working day, while it was precisely by setting the working time (8-hour day) that the absolute exploitation of the living labour force was limited and, as a result, the relative production of added value by technical innovation could be intensified. (Cf. Woesler 1978: 195) Finally, the individual capital must advance innovation, rationalisation and machinisation in order to be able to escape the tendency of the general fall in profit rates. It is the methods of relative value-added production that lead to an increase in the value-added and profit rates and at the same time to an increase in the technical composition of capital (and possibly to an increase in the organic composition of capital). And this does not prove to be a cunning plan of capital! Once recognized, according to Marx, these methods necessarily constitute the continuous progression of the accumulation of capital also at the overall level, through competition and its principles of correction (and, tendentially, the fall of the general rate of profit).

In Capital Vol. 1, Marx adopts certain statements by Charles Babbage on the structure and function of the division of labor in the manufactory and sharpens them to the question of the social function of the combined total worker in machine production. This total worker is equated with productive work; in addition to the manual worker, it also includes managers, engineers, technicians and supervisors. According to Marx, a very specific group of wage earners emerged within the overall worker: "Like an army of military officers, a working mass of industrial senior officers (conductors, managers) and non-commissioned officers (labour inspectors, foremen, overlookers, contre-maîtres) working together under the command of the same capital is needed. (MEW 23: 351) The concrete form of the total worker is determined according to the technical level of the division of labour. In the factory, in which the social body is already present as a (symbolic) machine and as hardware, the combined total worker gradually occupies only a subordinate position vis-à-vis the machinery or the mechanical automaton. Marx writes: "In the factory a dead mechanism exists independently of them, and they are incorporated into it as living appendages ... While machine work attacks the nervous system to the extreme, it suppresses the versatile play of the muscles and confiscates all free physical and mental activity. Even the facilitation of work becomes a means of torture, in that the machine does not free the worker from work, but his work from content. It is common to all capitalist production, insofar as it is not only a working process, but at the same time an exploitation process of capital, that not the it is not the worker who applies the working condition, but conversely the working condition which applies the worker, but only with the machinery does this reversal become technically tangible reality. Through its transformation into an automaton, the means of labor during the labor process itself confronts the worker as capital, as dead labor that dominates and sucks out the living labor force. (MEW 23: 445-446) It is striking in this quote that Marx first, perhaps a little too forcefully, emphasizes the purely levelling pressure of dead labor on manual labor and the repressive function of machinery and therefore underestimates that the productivity impetus of capital must, to a certain degree, also aim at the mobilization of the progressive composition of human organs (brain, hand, muscles, etc.) as well as at the increase of human abilities as a whole (memory, perception, cognition, etc.). In addition to the tendency towards levelling work, Marx also considers the differentiation of work in the complex "factory" when he writes, for example, that a "partly scientifically educated, partly handcrafted working class is formed outside the circle of factory workers and only aggregates with them" (MEW 23: 443). It is the engineering and scientific work that is now definitely becoming the driving mode of production. Bahr writes: "The solution of capital was above all to transform factory and industrial production purely into reproduction, into mechanical machines, and to assign the convulsive of inventions and innovations its own controllable place in the form of scientific, technological and organizational laboratories. (Bahr 1983: 159) Here the dominant role of the control and logification of innovation finally begins, above all as the logification of the discourse in mechanical engineering itself (automation).

Only in the factory, whose constitutive, all-encompassing "element" is machinery, is the mathesis of relationship numbers consistently inscribed in the technical structure, and this inevitably requires certain systems of drive, tool, and transmission, which ultimately can also be written as symbolic machine operations. Internal division of labor also means the infiltration of functions such as organization, administration, planning and, in particular, the infiltration of new technologies into production processes. The factory is already a specific structure that, in addition to the scientific forms of expression, is composed of time axis manipulations and space organizations that are generated technically and mechanically. (Cf. Lenger 2003: 166) Thus, a completely new téchne is spreading to the structure of production, as a result of which, on the one hand, human work tends to be reduced to pure monitoring functions (while at the same time maintaining the uniform, monotonous partial work), but on the other hand, the worker's mind is released, and this as a condition for the emergence of technical-scientific intelligence. After all, it is the machine commands in particular that are supposed to configure the social body in the factory and let it be processed, so that monetary capital can increasingly smoothly blend into all possible production processes. (Marx identifies the machinery with fixed capital, which thus proves to be the adequate materialization of monetary capital).

Marx speaks of the fact that the constitutive functions of the machinery form a mechanism, i.e. a serial concatenation of fixed and moving parts, in which liquid and gaseous substances are later integrated, chemical transformations, magnetism, etc. Marx speaks of the fact that the machine's constitutive functions form a mechanism, i.e. a serial concatenation of fixed and moving parts, in which liquid and gaseous substances are later integrated. For Marx, who in Capital Vol. 1 is largely oriented towards his

own excerpts from Babbage and Ure with regard to the analysis of machinery, the machinery of classical industrial production is composed of three types: It is a conglomerate of drive, transmission and machine tools, whose basic structure forms a mechanism (concatenation of parts).5 Drive/force and tool function are combined by the transmission mechanism, a structure that is potentially already present in the working medium. Both the labor force, if it mutates into an integrated part of the production process, and the working objects or materials, if their qualities are understood purely instrumentally and as relations to be quantified, are then to be understood as parts of the machinery. It is the general functionality of the individual parts (auxiliary materials, manpower, raw materials) for production that makes them work equipment, and even the manufactured products are in turn means for further production etc..

Mediation becomes reality in the machinery. The transmission mechanism – one of three machine components – tells the machine tool the respective energy form and motion form (pendulum-like, circular etc.), so it can change the (structured) working object purposefully. The transmission itself is again produced by movement machines, wheel shapes such as the gear wheel or connecting cords, which enable uniform movement according to an identical time scale. Such a machine already tends to be a medial machine, which exists in between. However, one should not ascribe transport techniques to medial machines that transfer very specific meanings, contents or significates – the medial machine does mean, but without meaning anything specific. The medial machine, as the third, comes to the fore itself, as it were, without speaking. This describes the property of reference, with which materiality becomes indifferent sign carriers, insofar as the signs are preserving and maintaining. Materiality here becomes the carrier of a semiotic reference (microscope), but both pragmatically (the handling of machines) and semantically the referent of these signs remains indeterminate, indeed the medial machine itself refers again and again to new signs, statements, etc.. Thus technology theory increasingly turns to the syntax of tools and the axiomatized language of the sciences. Here the purely calculating or quantifying diagrammatics of mechanics is applied, a logic that proves itself and preserves itself through all transformations of the tools.

Marx points out that in the complex mechanical corpus of the factory – apart from transmission – it is not only the energetic drive machine (steam engine) with which the technical revolution of capital is forced that remains relevant, but also the machine tool, whereby it increasingly relieves the hand as a privileged organ of the productive body (and today almost completely replaces it if the pressure on the red button, which affirms or initiates a self-acting process, is the last residue of the work). Thus, in the course of the mathematization of production, work is increasingly broken down into partial operations; industrial machine tools are used, which not only relieve the hand, but finally break completely with the metaphysics of the hand (cf. Lenger 2003: 176), so that a multiple constellation of intelligibly productive machine bodies and parts emerges. Today's machine tools, their relations and parts, are sui generis purely inter-machine. Marx initially accentuates the enormous power and size of machine tools as an enormous multiplication of (human) forces. Soon, however, Marx will also focus on the technically instructed size of machine tools, the technical amplification of their force, for example when he speaks of "giant razors" or when he describes the operator of the drilling machine as an "enormous drill". (MEW23: 406)

At the same time, Marx is also concentrating on the engine and the drive units, of course – influenced by the experience of the energetic upheaval represented by the steam engine. Here, the engine stands in a certain contrast to the purely reproductive mechanics, in which the engine is merely understood as a transformer of energy or as a transmission mechanism. The heat (including its difference) causes the movement by producing the transformation of the aggregate state of the bodies. In the steam engine, the steam moves the piston, a process that requires the permanent restoration of equilibrium after its rupture (Serres 1993: 50); an equilibrium that is itself, however, only temporary, because the difference always erupts anew. Michel Serres writes: "The engine produces something, but by doing so it destroys something else, irrevocably. (Ibid: 51)

The heat machine with its difference production or its voltage gradient is the universal motor, insofar as its reservoir is universal – ark or capital, beginning and prerequisite of every chain of energetic transformations. Energy, be it force or heat, precedes work as nature, the earth as the first mover, which itself is movement. Or, to put it another way, the motor functions through the difference (temperature, explosion), but is not fed by it, so that it needs a reservoir, which at best is always full. (ibid.: 63) Serres writes: "Difference plus motion, that is the motor. And before him the reservoir." (Ibid.: 64) The reservoir encloses, it completes the real or chaos by rationalizing the real or chaos, i.e. capitalizing, by completing the potency of uncontrollable quantities. Through the reservoir, also the cloud becomes which Serres calls the primordial reservoir. The machines live from the cosmological energy, which is irreversibly transformed. The energy itself is not consumed in the machine, but the differences or voltage gradients of various forms of energy are.6

If the machines themselves finally function only as intermediate parts in the production processes, so that the machines largely mediate themselves, then each individual machine is to be understood as a machine element within machine complexes. So it is not only the different types of machines that justify the concept of the automatic system (the machinery), rather this concept is also to be understood as the consequence of another incision that was already visible in the manufactory, but could only materialize finally in the factory, namely the existence of the machine mechanism itself, whose constitutive characteristics are division and division, uniformity, repeatability, quantity and identical reproduction. (Cf. Bahr 1973: 44) In this machine mechanism, even living labor is still integrated as a machine element, while the tools have long since been transformed into working machines, "each of which forms a special organ for special functions in the system of the combined tool mechanism" (MEW 23: 400). It is only now that it can be said that at the level of the concrete production processes the uniform movement produces a measure, namely the identical unit of time. And so the factors division of labor, uniform movement, partial worker, identical serial production, division, structuring and time form the essential elements of a mechanical mechanism. And beyond this, the mechanism, according to Bahr at least, is regarded as a concept that indicates the tendency towards the axiomatization of the

machine beyond the translatability of physical phenomena. It is only in this sense that the industrial revolution then actually proceeds from the machines, "namely as a transformation of a still partially qualitative machine concept into an axiomatized, mathematical-logical one" (Bahr 1983: 261). Marx himself already sees clearly that the processes of sewing machines, as opposed to organic processes such as hand sewing, hold a completely different structural principle, and for this reason alone, machines as projections of the body and cognition in the course of mimetic imitation should no longer be spoken of at all. After all, automation means the increasing elimination of the body from production with simultaneous intervention of the natural sciences in production and the associated combination of self-referential and recursive technical processes with technically accessible natural substances (plastics). In these processes, the qualitative properties of the substances must be transformed into calculable and quantitative cause-effect relationships. Calculability also implies the anticipation or calculation of sales, the calculation of quantities and costs, the standardisation and alignment of the respective production parts, the end products and the machines. In the machinery, the tendency of living labor is reduced to activities such as assembly, which in the production process is often at the end of the mechanical partial operations, whereby the natural material to be processed is already confronted by the worker as a social natural form. (Bahr 1973: 46)

Let us come to the productivity of living labor and especially of machinery itself: Marx sees the productive aspect of machinery, the increase in its organic and inorganic potencies, first of all in the compression, in the approaching of its various elements in production and in the reduction of unproductive time intervals. Thus, at the level of individual capital, the time-saving linking of machinery with living labor must first, before innovation, aim at eliminating unproductive phases and thus increasing the output per given unit of time, i.e. a higher output than before should be achieved in the given factory body with a given amount of labor. However, Marx clearly sees a lack of innovative potential in a concept of production that aims above all at intensifying working times (and also the functional times of machines), and at consolidating the various machine elements (including the human element) and thus at eliminating the unproductive, which Marx must consequently locate outside of production, namely in research and science, which breaks into the capitalist production process especially as engineering science with its corresponding technologies, often those of technical administration. It can therefore be assumed that the driving functional operation of value-added production consists first in the elimination of the unproductive elements and phases of production and later in the replacement of living functions by new technological constructions, innovations and machines that function purely according to the principles of the monetary form of capital (relative value-added production).

The transformation of labour activity into machine assembly, transport, regulation and control formed the basis for the emergence of engineering, which in the 20th century incessantly seeped into industrial production. Polytechnic universities, the first of which was founded in Paris in 1895, developed a technological device containing three essential elements: the idea of totality, encyclopaedic plurality and the idea of progress. While in theoretical mechanics the machine was increasingly reduced to an intermediate part serving the transformation of energy, in the course of anthropologizing enlightenment the moment of cunning returned to the machine discourse with the figure of the engineer, who was often ascribed an extraordinary inventive power. Bahr sums up: "The mechanical-deductive definition of the machine could only be enforced because the concept of growing productive power and progress was conceived purely anthropologically and referred to the progress of knowledge and ability". (Bahr 1983: 247) Thereby it is no longer only a question of outwitting nature, but of the téchne of knowledge inscribed in the machine itself, whereby by no means only the present of the machines is depicted, but in the course of the belief in progress knowledge is related to an as yet unknown future, so that here already from reference to "Inference" (Robert Brandom) is changed over.7

The practical-theoretical analysis of the industrial production process (and the inherent de-qualification of human labor) leads to a duplication, namely to engineering planning and the specific realization of the production process qua constant capital. Bahr writes: "Planning became, as it were, the internal price form as a process, i.e. the ideal form of the measure of value, while its objectification in proletarian work constitutes the emergence of constant capital as machinery". (Bahr 1973: 47) At the same time, the mechanization of knowledge takes place through the construction of specific organizations of education and research, and this in turn leads to new technologies, whereby technology and scientific knowledge remain integrated into reciprocal processes of increase. According to Simondon, the essence of invention lies in the technical object, which performs a previously unknown transindividual achievement. For Simondon, the invention marks the added value of the technical object over the deduction of engineering science. The specific way of concretizing gives the technical object a status that oscillates under its own direction between the natural objects and the scientific representation.

It is the specific structural form of constant capital that mediates between the scientific organization of production processes and the operative rationality of natural science. And with Marx, we can continue to proceed from total capital as the decisive form of capital, which, as a quasi-transcendental connection a priori and through competition and its correction mechanisms, imposes the use of new technologies on the individual capitals for the purpose of their self-preservation, completely independent of whether a concrete socio-political need for new machines or production processes exists at all; indeed, the individual capitals are even more and more forced to anticipate new technological innovations within the framework of their operational planning. Here, as Bahr rightly says, there is a virtually anticipated lack or the idea that without innovation and its realization in production, one's own company would simply disappear from the market. (Bahr 1983: 139) Here, too, the speculative moment is already set.

It is the experimental natural sciences and their inherent mathematical analytics that are adequate to the economically productive production process, the structured and clocked continuum of the processes integrated in these. However, experimental natural science does not translate itself one-to-one into technology, which would thus be degraded to a simple means of that, and in addition, the economy itself decisively negotiates the status of technology and technology in capitalist

reality. And yet a strange reversal is already emerging here: The capitalist production process becomes a place of (extended) reproduction transforms while the productive processes (innovation and creation) also take place outside the factory, whereby scientific-experimental research in turn inscribes itself into the structure of the production processes by means of its material-discursive practices and apparatuses. Today, even the growth theory of economics has recognised the momentum of technology (the result of targeted investment in research) as an essential growth factor (alongside labour and capital), provided that technology is capable of producing growing economies of scale. (Cf. Mazzucato 2014: 51) In a sense, industrial production becomes a derived process that lives, among other things, on the logification of a discourse that refers to all possible innovations in mechanical engineering, while work in the factory presents itself only as purely mechanical work. The monetary capital quantifies and controls the industrial production (mechanical, reproductive machinery), while the realization of inventions and innovations requires an equally controllable institutional site or scientific-experimental apparatus, the laboratory and its various measuring procedures.

In the middle of the nineteenth century, as Hans-Dieter Bahr also points out, Franz Reuleaux was deeply involved in the development of a deducible axiom system in mechanical engineering. (Bahr 1983: 139) Reuleaux eliminated the concept of the tool from the machine discourse and turned to an immanent description of the machine elements – concepts such as leadership, posture, drive and design emerged, the latter replacing the concept of the tool. However, Reuleaux was far from successful in developing a machine concept that describes machines purely as ensembles of functions, as is quite obviously the case with the computer today. It should be emphasized once again that, as Marx rightly pointed out, the use of industrial machines had in principle already completed the mathematization of production. In order to solve the problem of forces, theoretical mechanics initially understood the machine purely as the transmission of energy, whereby the force of action or capability was attributed entirely in the anthropological sense to the ingenuity of the engineer. In order to do this, it was necessary to imagine nature as constructed and constructible nature, in order finally to catch up with the difference between nature and machine, and this by introducing kinematics into mechanics. (ibid.: 250) The machine was then demonstrated as the result of a mobility of parts, the most important of which were the kinetic parts of posture and drive. At this point, Reuleaux already performed the deduction of a binary, purely mathematical theory of the machine. And this was later extended into the logic of the circuit, which processed with the binary pair working contact and rest contact and the disjunction. The technical relations in the mind are not only mapped, but also further developed by the mind. As deductive, discursive and mathematical logic, the production of knowledge gains a certain independence from industrial production processes, but is itself subject to industrialization, which leads to the separation of means of thought (laboratory, computer, data processing, etc.) and power of thought, and often produces enough processes of disqualification of scientific-technical intelligence. Thinking power insists here as a term as dark as productive power; it finally finds its most appropriate expression (condition/result) in scientific-experimental practice, insofar as it remains bound to a logical-mathematical system that materializes qua apparatuses in machines. (ibid.: 251) Even Marx was fully aware of the fact that the optimization of machinery and living labor, which tends to include the reduction of the latter (number) compared to machinery, must follow the imperatives of the capital economy, even the calculation of profit. Thus the experimental natural sciences only possess a utility value for capital if they materialize profitably as technology in the spatio-temporal constellations of individual capital for it, which touches the temporal relation of living and dead working time, which takes on an empirical-material form in the concrete works and machinery.

At this point it is necessary to distinguish at least two types of automation – the industrial-thermodynamic and the digital-electro-computational model. The industrial type produces a system consisting of numerous mechanical and intellectual organs plus the associated motors, whereby the workers are integrated as divided parts into the mechanical chains. In this field, Taylorism can be considered the decisive technological innovation of capital. With the assembly line, which transports the individual parts in a clocked, continuous mode in one line from one workflow to the next, a uniform time measure is installed, which integrates the worker into a new man-machine system. Taylorism divides the organism into specific movements and motion sequences in order to shape it according to the optimization of the production processes, i.e. to produce the effective synthesization of human-organic movement, the movement of the belt and the movement of the machine. According to Bahr, the body tends to lose its integral function as a utility value-forming and value-added-forming force. (Bahr 1973: 50)

The digital type of automation involves and mobilizes especially cognitive work and thus the brain and the nervous system as its parts, both of which are fed into machine networks producing endless data and information streams, but we also find pure machine-machine systems. In pure machine systems or, as Luciano Floridi says, third order technologies, machines interact as intermediate parts with technologies that act as users and triggers. (Floridi 2015: 52) If a machine is able to store data about its own respective state, i.e. incorporates a technology that writes data into it in recursive mode and, in the best case scenario, is capable of trouble-free feedback, i.e. transmits data back to itself as an instruction, then it is on its way from the mechanical machine to the cybernetic data machine that controls itself. (Cf. Lenger 2003: 182) Smartphones, laptops and tablets are primarily data processing machines. (Floridi 2015: 27) Cybernetic machines are already structured complexes that can deal with the laws of difference, relation and speed self-referentially. Thus, the machine automaton, when it processes the symbolism of binary difference, for the most part performs its iterations self-referentially by both writing and reading them in order to control, which, however, gives it monetary capital in the final instance as a guideline. The leap from the mechanical machine to the (universal) calculating and data machine of Turing, however, is not only to be thought of as a fundamental break, but also as a further step towards the completion of the machinery, so that one can state that the digital machine remains integrated into a productive technology with which the capitalist production processes are subordinated to a higher order. We can even associate the machine complexes and their calculating machines in the broader sense with Heidegger's frame, or even more precisely with a

matrix whose diagrams (circuits, punched cards, tables, etc.) are transformed into an "algorithm" of time. (Cf. Miyazaki 2013: 36) The entire production process ultimately becomes diagrammatic, i.e. it is controlled by calculating machines that store various diagrams, which in turn are just waiting to become operative.

In the course of the expansion of relative value-added production, as Marx has already partially anticipated, capital is increasingly switching to the "intellectual" (and still physical) performance of the machines themselves, which correspond to certain protocols and the adequate organization of the sciences with their discourse and sign systems. The productivity of capital is now directly coupled with diagrammatic-machine relations. The automation of digital tracking systems, which regulate the shipment and distribution of goods, is dependent on low costs and fast transport routes, just as algorithmic forecasts of demand (just-in-time production) are dependent on ubiquitous monitoring. The system of a "standing reserve" of goods based on past labor is liquidated as unnecessary loss and replaced by a system of potentials of the future; it is a system designed to maximize profit and continue to need barter, but at the same time creates continuous uncertainty because any interruption creates the risk of shortages and shortages. (Marx repeatedly points out that on the one hand the workers are trapped in the integral of the machine-technological factory body, on the other hand the machinery is also confronted with them as externality. Thus the machine relation itself seems to attain subject status, whereby the productive capacities are increasingly to be found in the organization and the internal composition of machine parts, while in the tendency the ego-assuring gesture of the working subject is reduced to an offended narcissism.8)

According to Marx, one of the essential performances and functions of capital is to open a téchne that makes constructible an energetic-temporal-spatial continuum, namely that of the factory, a period that capital can capitalize in nuce. To do this, the workers must be in a simultaneity, they must arrive at synchronous times in the factory, which appears as the point of space. (Cf. Lenger 2003: 162f.) At this point one already has to deal with the worker as a per se divided individual, i.e. an individual, that belongs to a simultaneity in space. But not only the worker and his physical and mental potentials are divided in the factory, but overall the productive body or the mechanical complex is subordinated to a logic of the digital and discrete, with which permanent divisions are carried out and the mechanical complex is set into ever new spatial variations (and temporal oscillations). Here, space implies the staging of a simultaneity that monetary capital ultimately has at its disposal. Here, space is the material result of monetary inscriptions that are presupposed to it.

Capital contains the claim to multiply infinitely in principle, thereby also capitalizing time, inserting it into a continuum of a specific return, the equalization of what is to come. Incessantly, with the calculation of the future, capital generates a present that is entirely under the dictum of added value, which in turn is to be gained from future exploitation. And thus the capital of mere simultaneity in space always tries to escape as well. When Lenger speaks in this context of the "crowding together of time and space by means of communication and transport" (ibid.: 162), then he refers to a technological incision that repeatedly generates the space of the factory anew and thus itself becomes a function of transmission, which in turn enables the techniques of time to include a future to be calculated as the best of all possible presences, in order to thus completely accomplish the appropriation of the future.

The clock was the first automaton used for practical purposes, Marx wrote in 1863 in a letter to Engels. (ibid: 178) It is an automaton that generates an infinite sequence of even ticks and with the help of which the multiplicity of bodies in the factory can be smoothly integrated into the mechanical structure and condensed into "poreless suppleness" (ibid: 178), so that with the assertion of the economy of time, production acquires a temporal structure adequate to the monetary capital relationship.

The mechanical clock provides the exact and continuous measurement of time, taking into account the uniformity of movement, and this may be regarded as central to the development of machinery if it is examined from a temporal point of view. (Cf. Woesler 1978: 208) The clock refers to a precise concept of the machine in so far as the trap (field of blasting) is set as a trap qua barrier, whereby the barrier in turn becomes the mode of triggering (blasting); that is, the inhibition (trap that binds the projectile) not only blocks the spring's rebound, but at the same moment also triggers its fall, it censors the fall. And it is only through the repetition of the caesura that the uniform movement occurs. (Cf. Bahr 1983: 210) The continuity of movement must be ensured by a rigid mechanism that is supposed to be in flux at the same time, and this particular constellation indeed produces the inhibition mechanism. Thus, in the case of the watch, which consists of a movable gear wheel, the escapement mechanism interrupts the movement of the wheel and produces the ratio of continuity and discreetness in the uniform flow. 9

Although Marx often analyses the machine complex in the universe of thermodynamics (motor, force, mechanics and transmission; energy constancy and entropy), he expresses his conviction by referring to the clock that material-machine practices and complexes have specific time techniques attached to or even superior to them, which discretely break down the analogue continuous process of production into individual elements in order to reduce or, better still, completely eliminate as far as possible any interruption and any unnecessary noise of the analogue. The forms of today's digital technology conceal the logic of division and discrete that inscribes itself with its own rhythmology into the concrete machine and media structures that store, calculate and transmit. And this is perhaps the uncanny thing that makes many people talk about the animation of the machine again today. It is mathematics, or, as Marx says, the science of relational numbers, which determines the logic of the machine. And the automatism of machinery today takes place in the medium of self-reference or self-control, which means that the binary code, due to its simple technical realizability and numerical efficiency, is regarded as the most effective number system (also in demarcation from language) and refers to itself mechanically. However, the logic of data recursions already flashed in the automatic loom, which anticipated the machine of all machines, the computer, at least from a techno-logical point of view. It can be seen that it was the mathesis of the discrete clock that on the one hand standardized the daily routines in the factory, and on the other hand controlled the production or the machine complexes, insofar as it could establish itself in reality as time and

quantitative measurement.
So it was digital time techniques that, in the course of the industrial revolution, already immigrated into the energetics of drive, power and transmission as well as into machine tools, that is to say, generally materialized in machinery. Thus it must be noted that digital techniques are inherent in capitalist production processes per se. (Cf. Lenger 2003: 178) This also includes the fact that the discourse on the machine at the above level had long since encircled the detonating machines in order to determine the machines entirely from the point of cognition, from the point of becoming integrated with perception (time and space) and transcendental subjectivity. (Bahr 1983: 211) Space and time have to be presented as a priori structures in order to subordinate the machines as moments of blasting and encounter (trajectories) to the trap and thus to grasp them as containers of all movements. Every machine that rushes out or escapes seems already caught up by space and time, even though it exists only in the curved energetic space-time and can thus also register back again and again as a blasting machine. It is precisely against every type of detonating machine that the clock repeatedly raises its bleak objections: if time cannot be a measure of movement without itself becoming a movement machine (clock), then "uniformity" is a symmetrical reflection of the machine, its own reflexivity. (Bahr 1983: 219) The a priori of time and space (space as such and time as such) may be a "philosophical artifact" (Serres 1994: 86), but it has not missed its power-political and economic effect. The certainty that Euclidean space and universal time hold in themselves is ultimately a result of the socio-storical-material practices of economy, science, politics and theology. However, if space is locally Euclidean, there is no reason to define global space as Euclidean. (Ibid.: 90) And so it is with linear time, which was first measured by water clocks and sundials, mechanical clockworks, whereby it was assumed that linear time would also run in the future as it had run in the past. Nevertheless, and the steam boiler of the industrial revolution already shows this, order or reversibility – in the unity of an objective system – is constantly moving in the direction of disorder or irreversibility. But we also have to deal with the opposite tendency. Michel Serres states here an extremely interesting paradox:"At the moment when a new work, the production of power and energy, is about to burn with almost vertical acceleration all the reserves that have been slowly deposited during the history of the Earth; at the moment when this new work decides to burn time, because the raw materials are ultimately nothing but time; at the moment when the new work strengthens the irreversible through this regression, the social and political order suddenly freezes in the notion of work, the eternal return of the reversible.« 10(ibid.: 99-100)
One can now first of all sum up that from a technological point of view it is the clocked machine that combines the relation of division, digitality and discreetness in one unit, and that at the same time is conceivable as a continuously flowing quantity, thus opening up the war history of capital in a temporal respect. Lenger writes: "In the machinism of industry, which extends to indefinite times, the time war of capital becomes the economic principle itself". (Lenger 2003: 184) And Marx writes about the genealogy of these time wars: "The doctrine of friction and thus the investigations of the mathematical forms of gear train, teeth, etc. all made at the mill; ditto here first of all the doctrine of measuring the degree of the moving force, of the best way to apply it, etc ...". (MEW 30: 321) The mill is considered by Marx here in its function of time measurement since it on the basis of uniform movement of dynamic mechanics can solve in real terms the problem of preservation and change from the point of view of quantitative optimization. Hans-Dieter Bahr revises Marx to the effect that it is not the water mill, but rather the transmission, independent of the respective driving force, which is to be regarded as the elementary form of the modern machine (lever and wheel). (Bahr 1983: 345)

In the much quoted – and perhaps also somewhat overvalued – "machine fragment" from the ground plans, Marx suggests that the factory in which technological knowledge and technology (capital fixe) are linked in a specific way, involves special forms of communication or cooperation that ever point beyond the mere division of labor in which the economic determinants and the differential logic of the relational numbers have already settled. (Cf. Lenger 2003: 164) Cooperation, whether already incorporated in the manufactory or in the factory, indicates that in the production processes the spatial-temporal continuity is also repeatedly broken up, so that the coming together of the many (many do the same work) disturbs the pure function of utilization, which is realized with the help of the linear time economy of sequences and the arrangement of a homogeneous space. As part of a machine structure, the cooperation that first arrived in the manufactory seems to point beyond the time economy of capital, through moments of collective subjectivation that are part of a social brain. Lenger has identified the superfluous or parergonal (accessory), which cannot be eliminated by the work (érgon), above all in the cooperation that insists for him himself still in the factory, so that here non-linear, abysmal and multidimensional entanglements of technology and the social brain occur, which are not exhausted in the adaptation of the workers to the movement of the machinery. Lenger points out that for Marx himself, with regard to capitalist production, Platonic speech still remains in play. (ibid.:158) Alluding to the politeía, Marx writes: "If something is done only as a secondary work, the time corresponding to its production is often missed. The work cannot wait for the leisure of the one who has to carry it out, but rather the one who has to carry out the work has to orient himself according to the conditions of his production etc., therefore he may not operate it as an ancillary work. (MEW 43: 277) Nevertheless, according to Lenger, even the technique could still split, since on the one hand it appeared as a "means" that served the calculated purposes, while on the other it kept a parergon at least in its seed, the accessory or the virtuality, the disturbance or the interruption, the coincidence or the anarchy of unpredictable effects. The machine and the worker thus cannot be completely isolated from the parergonal free gifts, and certainly not from the side effects, be they internal disturbances in the production process or the resistance of the workers in the class struggle, which must be overcome by capital in such a way that productivity can be increased as frictionlessly as possible by means of relative value-added production. According to Lenger, the time economy of the factory guarantees smooth processes only by not being able to free itself from a resistive distribution or cooperation in the same breath.11 With the implementation of the time economy of capital, the use of disciplinary techniques, which bind the teachable body of the entire worker to the organization of the technical mediality of the machines, becomes indispensable in the factory.

Here, then, the “class struggle” intervenes in a very specific way in the body of the factory: Capital leads it above all with the various methods of producing relative added value (innovation and rationalization), with which the necessary labor is reduced in relation to overtime and at the same time the autonomy of the workers is attacked, while the workers react to it with a multitude of resistances, and these also in turn cause capital to further force the relative production of added value. With regard to relative value-added production, not only the natural sciences play a decisive role, but also the combinatorial “logics” of capital fixe, especially when they implement certain innovations as the mathesis of machine programs.

Lenger points out that in Marx's text the terms technical composition of capital (relation of living labor to raw materials and machines) and value composition of capital (value-based relation) are not identical: Marx therefore rightly assumes the interaction of the two areas. Marx writes: “There is a close correlation between the two. To express this, I call the value composition of capital, in so far as it is determined by the technical the organic composition of the capital.” (MEW 23: 640) It is well known that Marx assumes that capital at least tends to have a growing organic composition, i.e. that in the course of the various thrusts of technical innovation there will be a growth of the constant versus the variable capital share. The organic composition is therefore less about some kind of liveliness than about the mediating function (between economy and technology), with the capital economy tending to push for the continuous revolutionization of production technologies.12 Insofar as Marx speaks in this context of the relationship between dead labor (constant capital) and living labor (variable capital), the former absorbing the latter, one can also assume a constellation in which life and death intermesh as terms of economy. Lenger, in his Marx Zufolge paper, even goes so far as to speak of the law of the tending case of the general profit rate as an indicator of the death instinct of the capital economy, whereby in the processes of capital accumulation dead labor – the materialization of labor in the machinery – permanently increases in relation to living labor in the form of the worker. (Lenger 2003: 206) Just as Freud was not primarily concerned with the implosion of organic life in the formulation of his theory of the death drive, so Marx was little concerned with the assertion of the tendency of an increasing organic composition of capital to be a kind of theory of collapse that recurs to the fact that capital is increasingly losing its only value-adding factor, the living labor force, in the course of the technologization of all production processes. Rather, here the term “death instinct” primarily concerns the inorganic matter of means, which cannot be separated at all from semiotics, although semiotics is less a text that is always different from economics, as Lenger assumes, but rather a specific a-signifying semiotics related to capital. If Lenger at this point cites Lyotard in agreement, who in his writing Der Widerstreit writes that the economic discourse extends itself to propositions that are not subject to the rule of exchange, or that at least the latter intends this (Lyotard 1989: 284f.), Lenger situates his concern still entirely within the framework of the discourse of linguistics, in particular the grammatology of Derrida. When the téchne is crossed by the grapheme, the difference continues in it west, but the writing that here concerns the difference of technical sentences can also be transformed into the concepts and sentences of capital. Lenger writes: “It concerns the question of the extent to which the exploitative value of its equally withdrawn and inalienable linguistic or graphematic preconditions can be used to postpone its ‘death instinct. (ibid.: 213) And Lenger's answer remains consistently ambivalent, insisting on the differential shifts triggered by the grapheme. On the one hand, capital, which only recognizes difference to itself, designs a mathematical writing that naturalizes itself as a machine process of zero and one in the computer and progresses as mathesis. On the other hand, the caesura of writing could not be translated purely into economic expression; on the contrary, its parergonal potential would repeatedly attack the economic concept.

Lenger finally points out that not every increase in the technical composition of capital must lead to an increase in the value composition, because constant capital can also become cheaper in the course of productivity increases, which, as can be stated today, was actually the case with the introduction of new production methods at the beginning of the 20th century and later with the cybernetization of production processes and the introduction of microelectronics. Cybernetic machines not only replace manpower, accelerate and make production processes more efficient, they also reduce machine wear. They thus reduce the speed of circulation of constant capital and reduce the cost of its amortization. But it is precisely in this way that capital releases at the same time new medial flight speeds, and this not only with regard to the blocking of the tendency of the fall of the general profit rate, but also in so far as it now migrates into hardware, which has developed as thinking from the conditions of writing (and semiotics, as is to be added). (Ibid.: 212) At the same time, however, material synthesis in the universe of digital machines – machine writing and semiotics – can only develop in correlation to into a functional machinization that serves capitalization rather than evading it. The cybernetic production processes, which imply techniques of processing, storing and controlling data and information, are to be understood here as strategic conditions of capital-infected rationalization, insofar as they must be profitable per se.

translated by DeepL.

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